PRESSURE OXIDATION

Responsive
Releasable

DAVIS BROWN
LAW FIRM
515-288-2500

sherritt technology

Aug

DAN —
ANY INTEREST ?.
PLEASE RETURN WHEN
UN INTERESTED —
Jim

Brohm Mining Corporation
P.O. Box 485
Deadwood, South Dakota
U.S.A. 57732

Attention: Mr. Jim Barron
Senior Geologist

Subject: ***Gilt Ed***

Further to our telephone conversation, I am pleased to send you a profile of Sherritt Gordon Ltd. Our company has a long standing expertise in the operation of autoclaves and has developed novel processes in the treatment of sulphide bearing materials, including the recovery of gold from refractory ores and concentrates.

At our Fort Saskatchewan site, we have laboratory facilities to test the materials in either bench or pilot plant scale, to establish optimum processing routes, and ultimately, for designing commercial plants.

The Sherritt Gordon Pressure Oxidation process for the treatment of refractory gold ores and concentrates is a proven commercial technique. The process being used by Homestake at their McLaughlin mine was tested in the Sherritt laboratories. Sherritt provided the test program and developed the process engineering design for the Sao Bento Mineracao Plant in Brazil. The Aegean Metallurgical Industries SA. plant slated to start up in Northern Greece in 1990, is using our process. Several other projects are in the final stages of evaluation.

I am enclosing for your information, the following Sherritt brochures and papers:

- Sherritt Technology
- Sherritt Gold
- Role of Pressure Oxidation
- The Sao Bento Gold Project Pressure Oxidation Process Development, and
- Start up of the Sherritt Pressure Oxidation Process at Sao Bento

Sherritt Gordon Limited
Fort Saskatchewan, Alberta, Canada T8L 2P2 / Telephone (403) 998-6911 / Telex 037-2290 / Fax (403) 998-6568

sherritt technology

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We will be pleased to discuss with you the application of our technology to your specific requirements. Please feel free to contact the undersigned at (403) 998-6908.

Looking forward to hearing from you I remain

Yours very truly,

N Torres

Nestor Torres, P.Eng.
Technology Marketing Coordinator

NT:ks
Enclosure


RECEIVED
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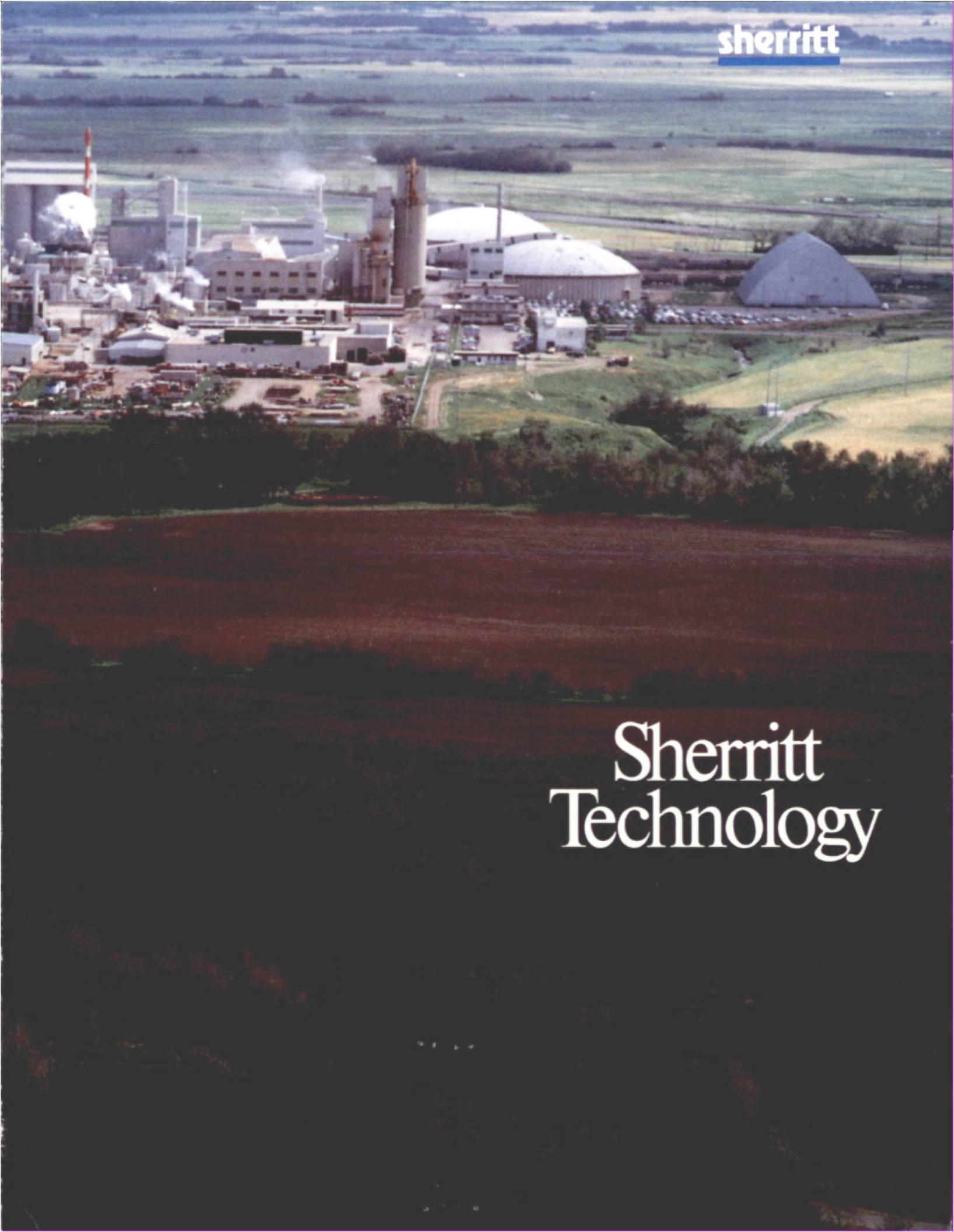
BROHM MINING CO.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Sherritt
Technology

Sherritt History

Sherritt Gordon Mines Limited was incorporated in 1927, to work a copper-zinc orebody at Sherridon, Manitoba. Nickel/copper discoveries farther north in the province led to the development of a new mine at Lynn Lake in 1953.

In the meantime, a search began for a method of refining nickel that would give better recoveries at lower operating costs than conventional smelting methods. Scientists working for Sherritt came up with an innovative ammonia leach process to produce pure nickel and cobalt without smelting, and with ammonium sulphate fertilizer as a by-product.

This new refining method required large amounts of natural gas, so the company decided to go to the source of the fuel. In 1954, Sherritt opened its processing plant in Fort Saskatchewan, Alberta.

The Lynn Lake nickel mine was worked out in 1976, however nickel and cobalt still account for a major part of Sherritt's business: the company continues to refine and fabricate these metals from feed acquired from outside sources. Sherritt remains active in northern Manitoba where it operates a copper-zinc mine and recently started up a new gold mine and mill in the same region.

The Sherritt ammonia leach process is also used under licence by other companies, and about 40% of the pure nickel produced in the free world today is refined by Sherritt processes, which have the distinct advantage of avoiding air pollution generally characteristic of conventional smelting methods.

The major by-product of the Sherritt refining process is ammonium sulphate, a widely used chemical fertilizer, and the company began to market this useful product soon after the refinery opened. Other types of fertilizers were added to the line and the company now manufactures and distributes a full range of nitrogen and phosphate fertilizers. In 1983, ammonia and urea production increased with the addition of world-scale plants.

Sherritt also followed up on the refining activities by opening a rolling mill at Fort Saskatchewan to produce high-quality nickel and cobalt strip from powders. The nickel strip was ideal material for coinage blanks, so the company soon found itself literally in the business of making money. Sherritt began by selling coinage blanks to the Royal Canadian Mint, and later added its own minting facilities. Today, Sherritt manufactures medallions, tokens, and trade dollars, as well as finished coins for legal tender in a number of countries. A contract for transfer of nickel-bonded steel coinage technology to China has been negotiated and Sherritt will supply the blanks for the new Canadian one dollar gold colored coin.

The company has an active research and development arm. The Sherritt Research Centre at Fort Saskatchewan has built a strong reputation for innovative problem-solving and its expertise has become, in effect, another product the company sells. To market Sherritt's expertise in the fields of metallurgy, coinage, and special products, the External Technology group was recently formed.

ALBERTA OPERATIONS – FORT SASKATCHEWAN

1 SOUTH GATE HOUSE
2 ADMINISTRATION BLDG No 1
3 RESEARCH CENTRE
4 AGRONOMY BLDG
5 & 5A NBS PLANT & MINTING BLDG
6 ROLLING MILL
7 ANALYTICAL SERVICES
8 COBALT PILOT PLANT
9 COMPUTER SERVICES
10 ADMIN BLDG No 2 E & IR
11 MEDICAL BLDG
12 PURCHASING & LOCKER BLDG
13 FERTILIZER EXPANSION OFFICES
14 LUBRICANT STORAGE BLDG
15 AMM SULPHATE PROD BLDG
16 UREA PROD BLDG
17 UREA GRANULATION
18 AMM SULPH STORAGE
19 FEED UREA STORAGE
20 FERTILIZER UREA STORAGE
21 & 21A AMM SULPH & UREA BAGGING
22 SULPH ACID PLANT
23 PHOS ACID PLANT
24 AMM PHOS GRANULATION
25 FERT BLENDING BLDG
26 PHOSPHATE STORAGE DOME
27 AMM SULPH STORAGE
28 FERT BULK WEIGH BINS
29 TRACK SCALE
30 & 30A FERT BAGGING & BAGGED STORAGE
31 FIRE HALL
32 EAST GATE HOUSE
33 PHOS ROCK STORAGE SILOS
34 PHOS ROCK UNLOADING
35 H_2SO_4 PLANT WATER COOLING TOWER
36 OXYDROLYSIS RED'N & METALS HANDLING
37 NI STORAGE BLDG
38 SAMPLE PREP'N BLDG
39 No 1 WAREHOUSE (R. MILL STORES)
40 SULPHIDE PREC'N BLDG
41 POWER HOUSE
42 GAS REFORM PLANT
43 SELAS FURNACE
44 No 3 & 4 WAREHOUSES
45 No 5 WAREHOUSE
45A MAIN ELECT'L SUBSTATION
46 20 000 T AMM STOR TANK
47 AMM COMPR BLDG
48 AMM STORAGE SPHERES
49 AMM PRODUCTION PLANT
50 GARAGE
51 CARPENTER SHOP
51A STORAGE SHED
52 MAINTENANCE SHOPS
53 AMM WEIGH HOUSE
54 No 2 WAREHOUSE (STORES & RECEIVING)
55 WATER TREATMENT BLDG
56 WATER COOLING TOWERS
57 DEMONSTRATION PILOT PLANT
58 DEM PLANT FEED STORAGE SHED
59 LEACH PLANT
60 COPPER SULPHIDES SHED
61 CONCENTRATE UNLOADING SHED
62 CONC STORAGE SHED
63 CONC UNLOADING SHED
64 CONC STORAGE SHEDS
65 CONC STORAGE SHEDS
66 CONC STORAGE SHEDS
67 CRUSHING HOUSE
68 GYPSUM TAILINGS PONDS Nos 1 & 2
69 METALS TAILINGS POND No 1
70 COND COOLING POND
71 METALS TAILINGS POND No 2
72 METALS TAILINGS POND O F POND
73 GYPSUM C W POND
74 GYPSUM TAILINGS POND No 3
100 THIO-PET CHEMICALS LTD

Cover Photograph: Sherritt's Fort Saskatchewan Complex

Process and Product Technology

Sherritt has developed numerous processes for the recovery of non-ferrous metals from ores, concentrates and mattes principally by hydrometallurgy. Sherritt's expertise has also been extended to include technology for the production of coinage, specialty metal products, and sulphur-based chemicals.

ZINC

- Pressure leaching of zinc concentrates with return electrolyte followed by conventional zinc metal recovery.
- Sulphur recovered as elemental sulphur.
- Adaptable to low grade zinc or bulk concentrate.
- Can be integrated into existing roast-leach plants or used for "grass roots" applications.
- Commercial plants operating at Trail, B.C. (Cominco) and Timmins, Ontario (Kidd Creek Mines).

Zinc sulphide leaching plant at Kidd Creek Mines Ltd.

GOLD

- Oxidation of refractory ores and concentrates results in significantly increased gold recovery in subsequent cyanidation.
- Arsenic precipitates as stable ferric arsenate.
- In practice at Homestake Mining (McLaughlin) refinery.
- Sao Bento (Brazil) commercial plant startup in fall 1986.

Sao Bento gold plant under construction.

NICKEL – COBALT – PLATINUM

Ammonia Leach Process

- Recovery of nickel, cobalt and copper from nickel concentrates, mattes, and other feed materials.
- In operation at Fort Saskatchewan and Western Mining Corporation (Australia).

Cobalt Refining Process

- Treatment of nickel-cobalt mixed sulphides to recover pure cobalt powder.
- Practiced at Fort Saskatchewan, Outokumpu Oy (Finland), Impala Platinum (South Africa).

Matte Leach Process

- Acid pressure leaching of nickel-copper-cobalt matte to recover saleable metal products and a high grade PGM residue.
- In operation in South Africa at Impala Platinum Ltd., Matthey Rustenburg Refiners Ltd. and Western Platinum Ltd.

URANIUM

- Sulphuric acid pressure leaching of uranium ores to improve gold and uranium extraction.
- Commercial plant constructed by Anglo American Corporation of South Africa (low grade ore).
- Key Lake Mining Corporation (Saskatchewan) uses process for treating complex high grade uranium/nickel ore.

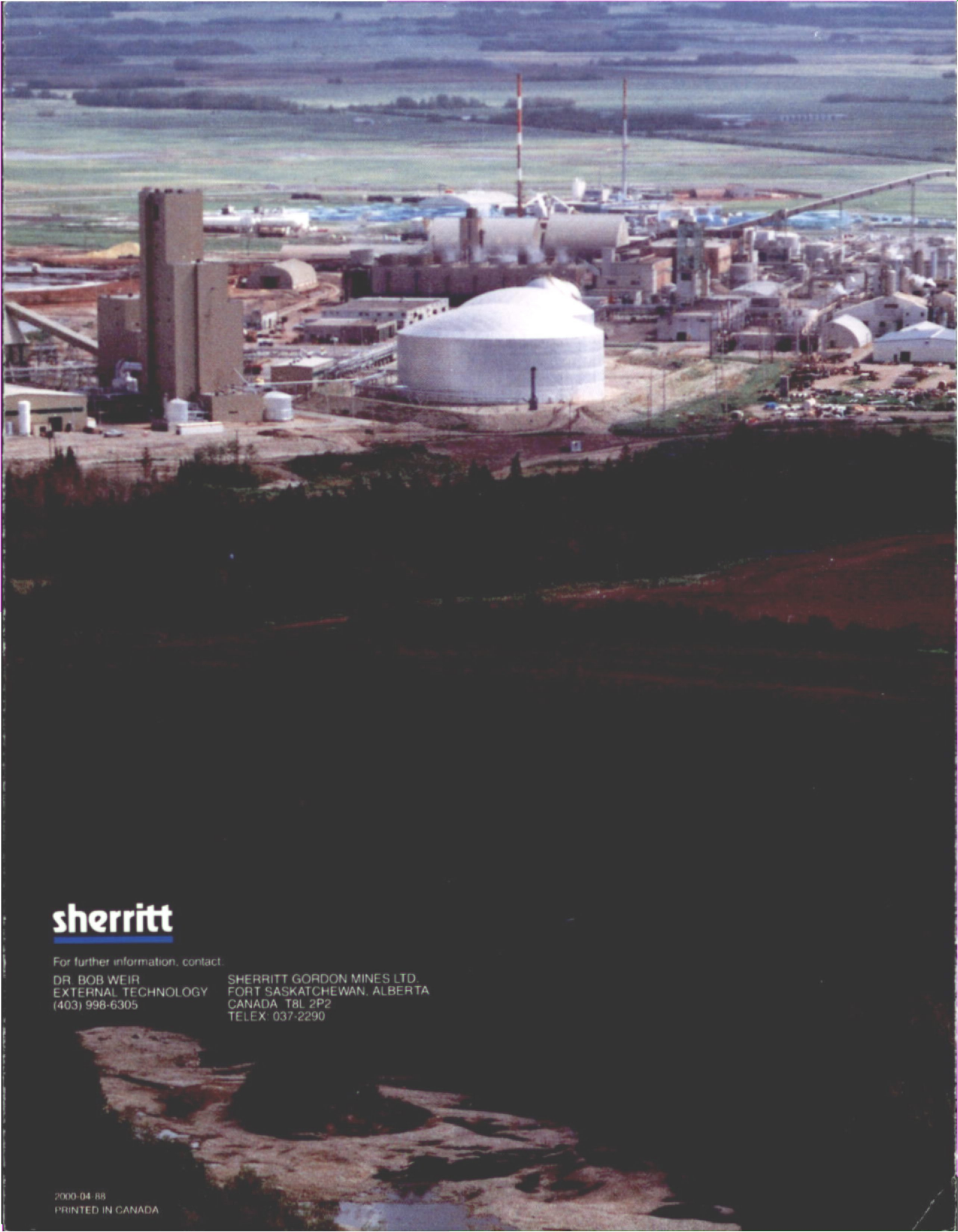
SULPHUR – CHEMICALS

- Technology for the production of H_2S, CS_2, sodium hydrosulphide, xanthate solutions, ammonium bisulphite.
- Sulphur recovery from sulphidic ores.

COINAGE – METAL PRODUCTS

- Process for production of nickel-bonded steel (NBS) coins, which exhibit properties of pure nickel but are less expensive to produce.
- Gold colored (aureate) coinage production using nickel or steel as the core material.
- Technology for production of high strength Co-Sm magnets.

Aureate coin blanks and medallions produced at Sherritt.



sherritt

For further information, contact:

DR. BOB WEIR
EXTERNAL TECHNOLOGY
(403) 998-6305

SHERRITT GORDON MINES LTD.
FORT SASKATCHEWAN, ALBERTA
CANADA T8L 2P2
TELEX: 037-2290

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Research and Engineering Services

Sherritt complements its technological expertise in the development and implementation of commercial ventures in the fields of metallurgy and specialty products by offering its clients a wide range of research, development, engineering, project management, operations and maintenance services. Listed here are some of the services which Sherritt can provide during the various phases of project development.

Process Development

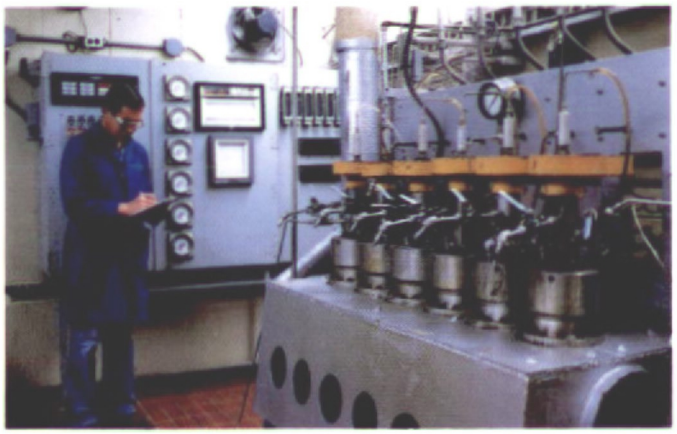
- Conceptual process research and flowsheet design.
- Bench scale testing.
- Continuous minipilot process demonstration.
- Corrosion/erosion materials testing.
- Environmental impact assessments.
- Physical metallurgy testing and product development.
- Capital and operating cost estimates and economic evaluations.

Plant Design and Construction

- Preparation of basic engineering design.
- Detailed design of specialized equipment.
- Inspection of specialized equipment during fabrication.
- Project management services.
- Computer simulation of process operation.

Plant Commissioning and Operation

- Preparation of operating manuals.
- Training of operating and maintenance personnel.
- On-site assistance during plant startup and operation.
- Continuing research, engineering and operational assistance.



Continuous pressure leaching testwork and process development and demonstration are conducted in Sherritt's Process Research laboratory.

Computer-assisted drafting (CAD) system is used to prepare technical drawings.

Recent Sherritt Clients

GOLD
- General Mining Union Corporation
- Homestake Mining Company
- METBA
- Porgera Joint Venturers
- SherrGold Inc.

ZINC
- Anaconda Minerals Company
- Australian Associated Smelters
- Broken Hill Associated Smelters Pty
- Cominco
- Compania Minera San Ignacio De Morococha S.A.
- Gamsberg Zinc Corporation
- Hudson Bay Mining And Smelting Co.
- Kidd Creek Mines
- Newmont Mining Corporation
- Noranda Mines
- Zhuzhou Smelter

COINAGE – SPECIALTY METAL PRODUCTS
- China Mint Company

NICKEL – COBALT – PLATINUM
- Anschutz Mining Corporation
- Impala Platinum
- Marinduque Mining & Industrial Corp.
- Matthey Rustenburg Refiners (Pty)
- Outokumpu Oy
- P.T. Pacific Nikkel Indonesia
- Seltrust Engineering
- Societe Anonyme Le Nickel
- Western Mining Corporation
- Western Platinum

URANIUM
- Afrikander Lease
- Anglo American Corporation of South Africa
- Key Lake Mining Corporation
- Uranerz Exploration and Mining
- Vaal Reefs Exploration and Mining Co.

SULPHUR – CHEMICALS
- Pyrites, Phosphates and Chemicals
- Thio-Pet Chemicals

sherritt technology

Nestor Torres

Marketing Coordinator
External Technology

Sherritt Gordon Limited
Fort Saskatchewan, Alberta
Canada T8L 2P2

Tel: (403) 998-6908
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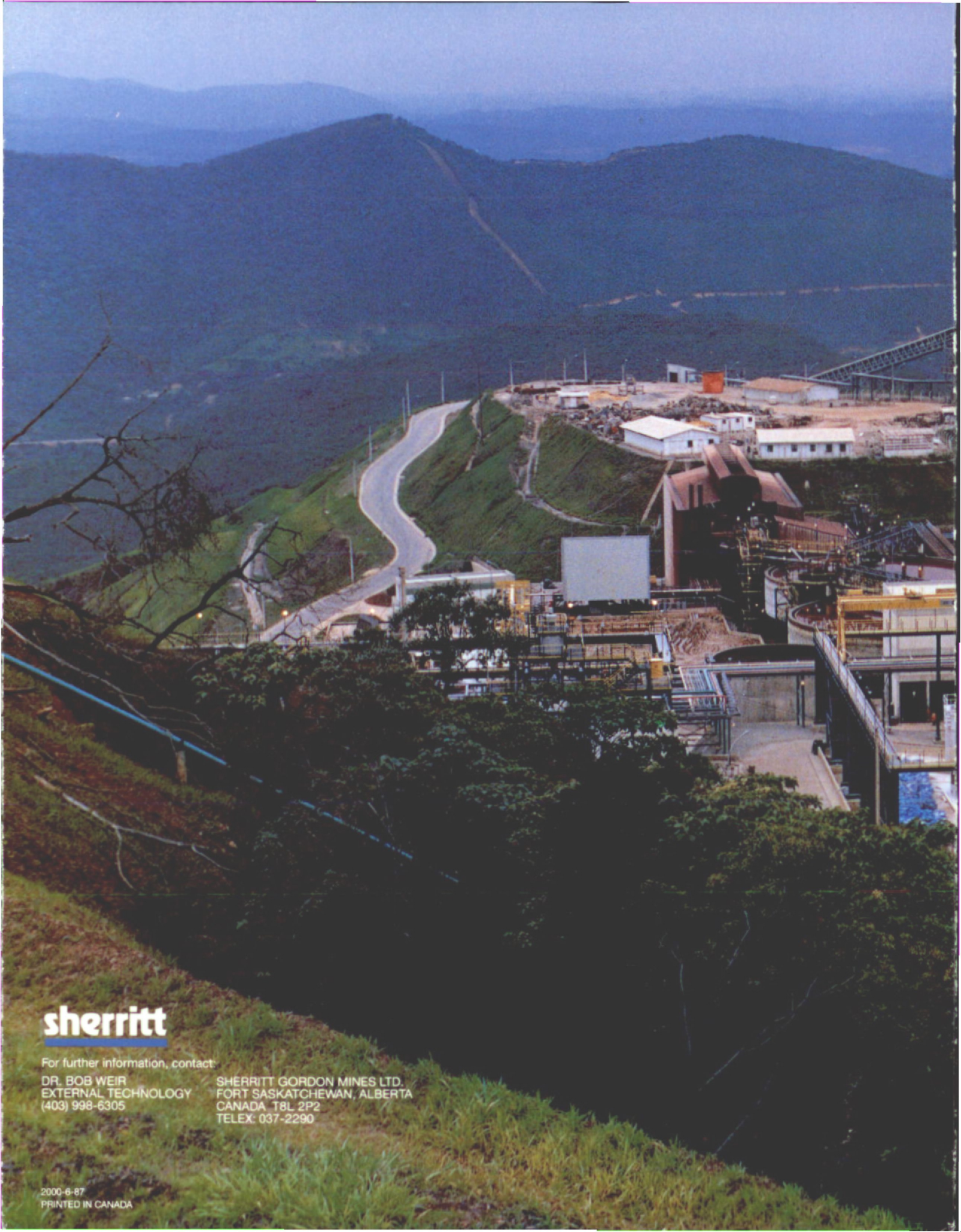
Telex: 037-2290



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Continuous pressure leaching testwork and process development and demonstration are conducted at Sherritt's Research Centre.

Computer process simulation is carried out through Sherritt's association with Kenwalt Pty.

Recent Gold Technology Clients

PROCESS DEVELOPMENT

- Aegean Metallurgical Industries S.A. (METBA)
- General Mining Union Corporation Ltd. (GENCOR)
- Homestake Mining Company
- Porgera Joint Venturers

COMMERCIAL PLANTS

- Sao Bento Mineracao S.A.
- Homestake Mining Company, California

The Process

Sherritt has developed process technology to recover gold from refractory gold ore reserves which eliminates the sulphur dioxide emissions associated with conventional roasting techniques. Many gold ores are refractory, that is, not amenable to efficient gold recovery by conventional cyanidation due to the dissemination of fine grained gold within sulphide minerals such as pyrite, arsenopyrite or pyrrhotite.

In Sherritt's refractory gold process, sulphide minerals are totally oxidized to the sulphate form thereby freeing the gold for recovery by conventional techniques such as cyanidation leaching followed by carbon in pulp extraction.

An example flowsheet for treatment of refractory ore by the Sherritt process is shown overleaf. The sulphide oxidation is carried out at approximately 180°C in an agitated, lead and brick lined pressure vessel (autoclave). Oxygen gas is added to the slurry within the vessel to react with the sulphides. Most of the iron and arsenic which initially go into solution as sulphate, precipitate as hematite and ferric arsenate in the latter stages of the autoclave. Subsequent treatment of the leach solution effectively removes all environmentally sensitive impurities as stable precipitates. Gold is recovered from the pressure oxidized residues by cyanide leaching followed by carbon in pulp extraction, yielding typical gold recoveries of over 95%. An enhanced silver recovery step can also be incorporated into the process to achieve typical silver recoveries of over 90%.

The Sherritt process has several advantages over the more classical treatment for refractory ores which involves roasting of the concentrates prior to cyanide leaching. Of particular interest is the elimination of gaseous emissions of sulphur dioxide and arsenic associated with roaster operations. In addition, the Sherritt process has a low sensitivity to the sulphur, antimony and lead content of the ore, allowing further optimization to improve gold recovery in the mill flotation circuits.

The first commercial application of Sherritt's refractory gold technology was at Homestake Mining Company's McLaughlin Gold complex, which has been operating since 1985. A Sherritt team recently assisted with the commissioning of the Sao Bento gold pressure oxidation plant in Brazil for a General Mining Union Corporation subsidiary, and several other commercial ventures have progressed through the process development and demonstration phases.

Sherritt can assist with process development, process demonstration, and engineering for treatment of conventional gold ores and concentrates. Sherritt provided construction management and start-up assistance for the MacLellan gold mill at Lynn Lake, Manitoba in 1986 and is carrying out the detailed engineering of a cyanide destruction system for this same facility. Sherritt operates the MacLellan Mine and Mill for SherrGold Inc.

Pressure oxidation autoclaves at the Sao Bento gold complex, Brazil.

TYPICAL TEST RESULTS — ORE TREATMENT

SAMPLE ORIGIN	ORE ANALYSIS, %				GOLD EXTRACTION, %	
	As	Fe	S	Au g/t	DIRECT CYANIDATION	PRESSURE OXIDATION –CYANIDATION
United States	0.48	1.5	1.6	31	11	96
Papua New Guinea	0.24	4.7	1.9	16	14	97
Canada	1.36	12.5	6.8	12	36	92
South America	3.63	20.6	6.4	10	25	98
Australia	0.96	5.3	1.1	6.6	51	96